CLAIMS

1. Membrane-separated, bipolar multicell electrochemical reactor for half-cell reduction and oxidation reactions in respective positive and negative liquid electrolytes, without gas evolution, including a plurality of alternately disposed bipolar plate electrode elements and ion exchange membrane separator elements, defining a positive electrolyte flow chamber on one side of each membrane and a negative electrolyte flow chamber on the opposite side thereof, sealingly assembled together in a filter-press arrangement between two end electrode elements electrically coupled into an electric circuit functionally including an electrical source forcing a current through the electrochemical reactor or an electrical load absorbing a current from the electrochemical reactor,

said bipolar plate electrode elements and said ion exchange membrane separator elements including a frame portion of an electrically nonconductive and chemically resistant material cooperating with sealing gasket means and having through holes and recesses in coordinated locations forming, upon assembling, ducts for the separate circulation of a negative electrolyte and of a positive electrolyte, cascadedly in all said negative electrolyte flow chambers and in all said positive electrolyte flow chambers, respectively,

characterized in that

all the frames of said bipolar plate electrode elements and of said ion exchange membrane separator elements have an inner flange portion, recessed from a first planar face of the frame on the opposite side of the other face of the frame having grooves for accommodating O-ring gaskets around pass-through electrolyte-ducting holes and around an outer seal perimeter, accommodating thereon a perimetral portion of the respective bipolar plate electrode or ion exchange membrane separator;

a plurality of retention pins project out of the surface of said flange portion and pass through holes of said perimetral portion of the plate electrode or membrane separator accommodated thereon;

electrode chamber along one side and exiting the chamber from the opposite side; and further characterized in that said porous electrode structure has two distinct comb-shaped channelworks, the finger channels of one channelwork being substantially parallel to each other and interleaved with the substantially parallel finger channels of the other channelwork; a first or source comb-shaped channelwork having a base or manifolding channel running along the side of the chamber through which the electrolyte is fed into the chamber and the second or drain channelwork having its base or manifolding channel running along the opposite side from which the electrolyte exits the chamber;

all finger channels of one channelwork extending from the respective base or manifolding channel and terminating short of reaching the manifolding channel of the other channelwork.

6. The electrochemical reactor of claim 1, wherein the ducts for the separate circulation of each of said negative and positive electrolytes defined by said through holes across the thickness of each frame portion of said bipolar plate electrode elements and of said ion exchange membrane separator elements are defined by two or more holes spaced along one side of the substantially rectangular frame portion.